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F16P 1/02, B23Q 11/08

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(56) Documents Cited

GB 2077878 A GB 1575338 A EP 0415025 A2  
US 4784544 A

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ONLINE: WPI; EDOC

## (54) A flexible protective cover with resilient hinged coupling elements

(57) A flexible protective cover for machine tools comprises rigid segments 1, eg aluminium extrusions, interconnected by resilient coupling elements 2, for example, of polyurethane. The segments 1 and/or the elements 2 are constructed in such a way so that they fold in on alternative sides. Alternate folding is achieved by providing the segments 1 with a curved surface 1d which encourages the direction of folding. The elements 2 has a greater amount of material on one side 2b than it does on the other side 2c. This results in unhindered folding on the side 2c and serves as means to further intensify the direction of folding. Sides 2b also serve as soundproofing since they prevent the longitudinal end faces 1a from striking each other. The segments 1 are retained by guide bodies (7', fig 5) in an upper guide rail (5', fig 5) and by guide bodies (8', fig 5) in a lower guide rail (6', fig 5) so as to be slidably and pivotably movable.

FIG.2

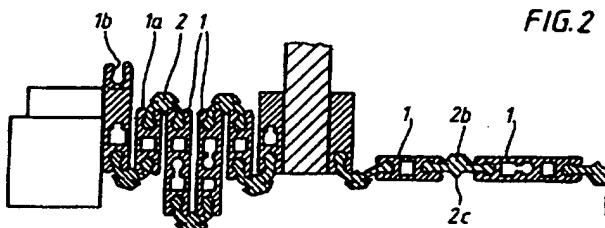
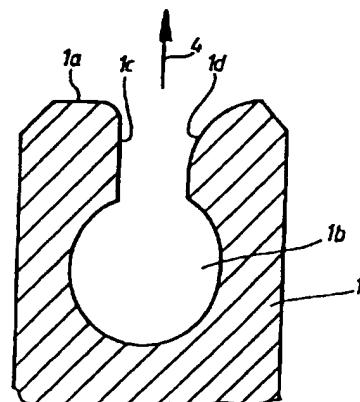


FIG.4



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FIG.1

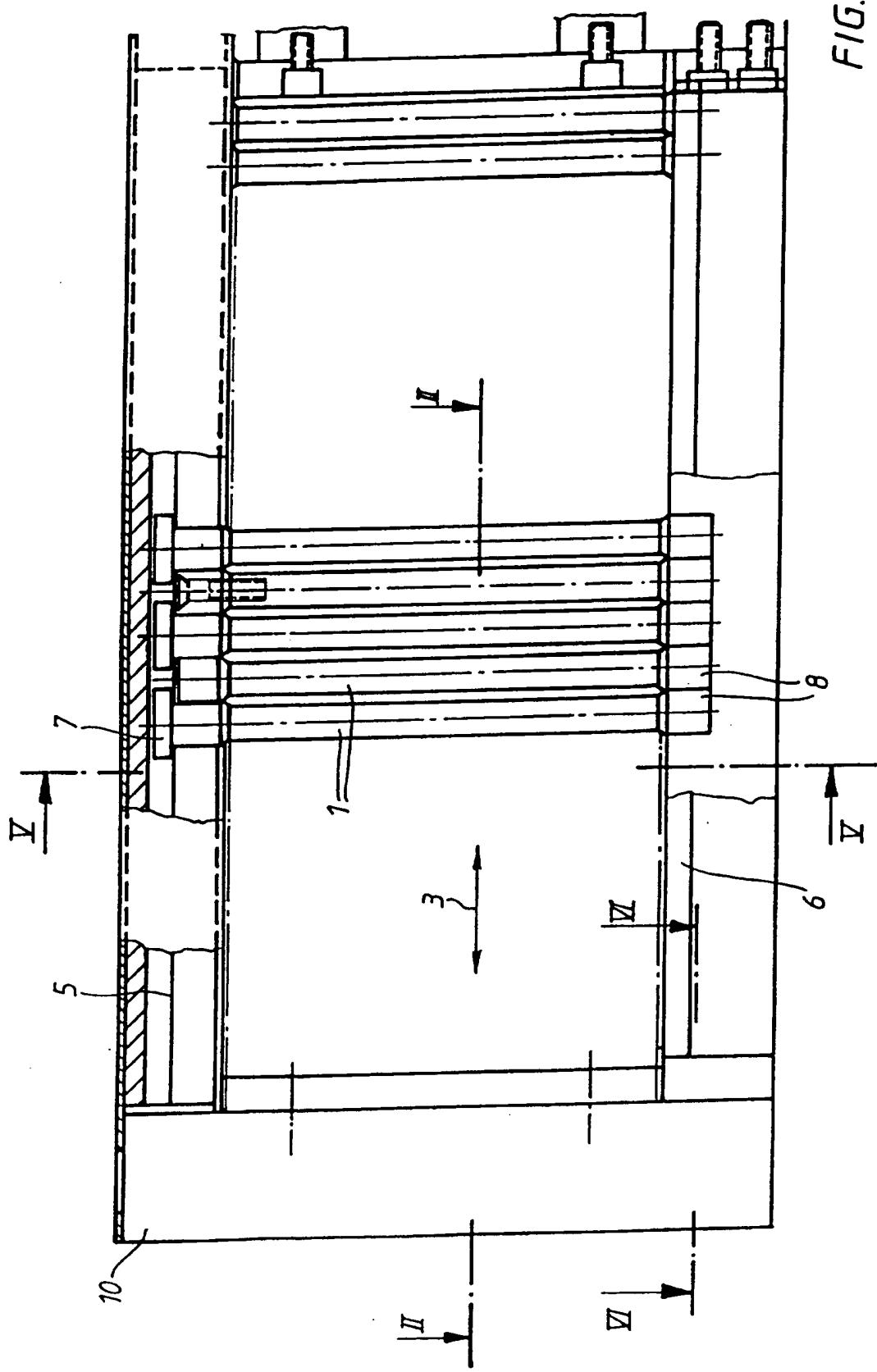


FIG. 2

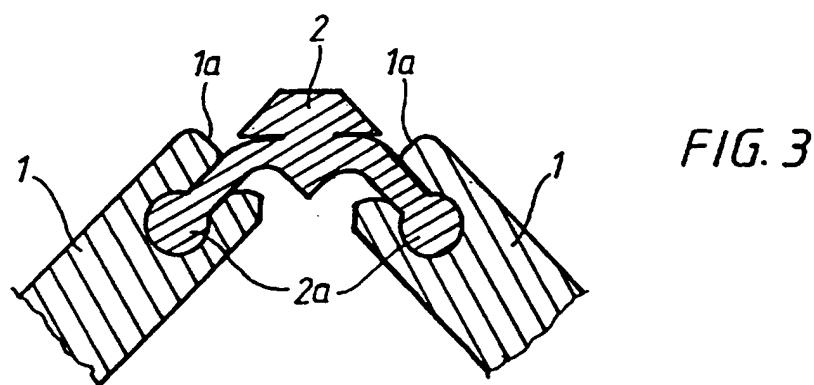
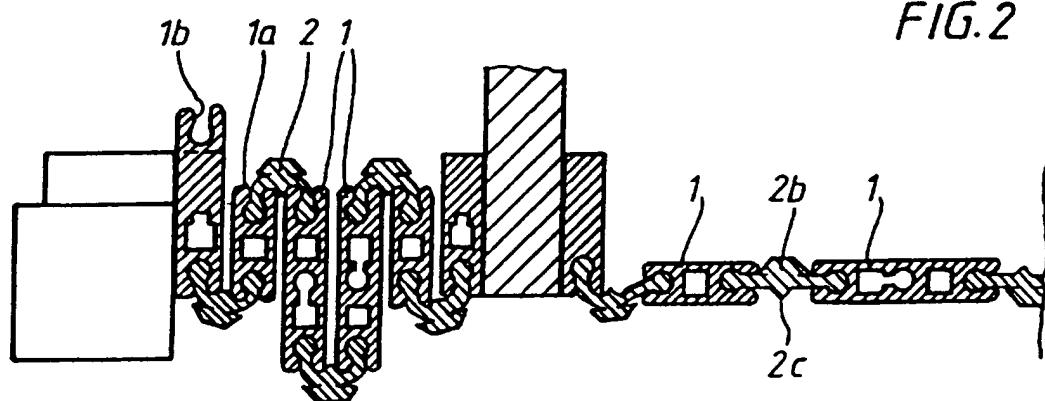
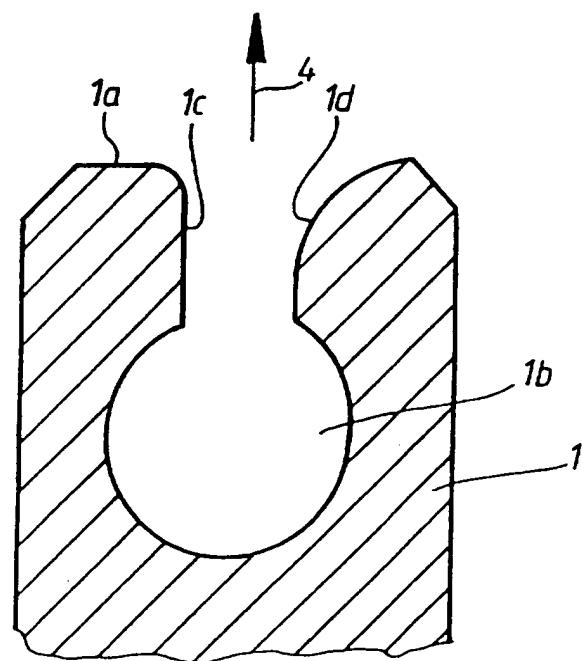


FIG. 4



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FIG. 5

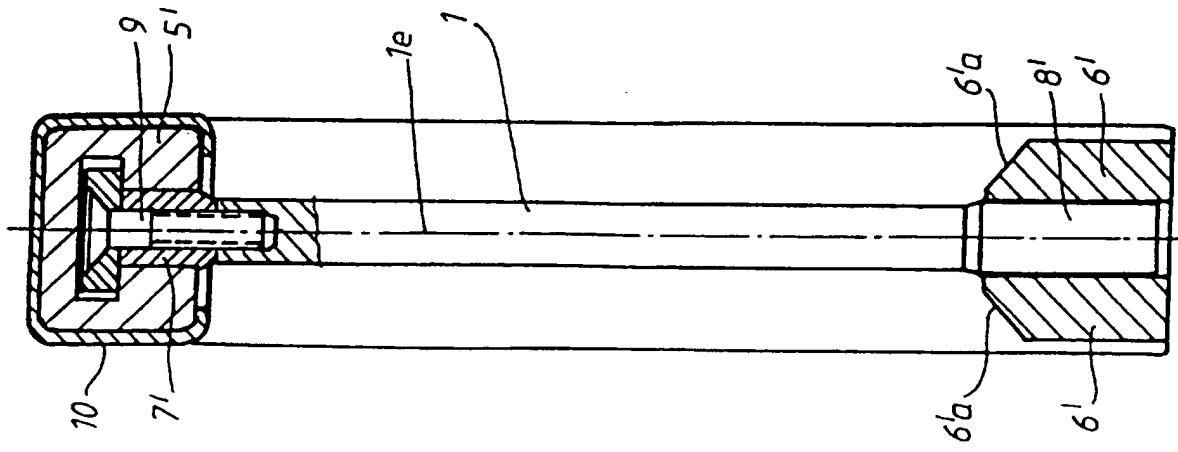
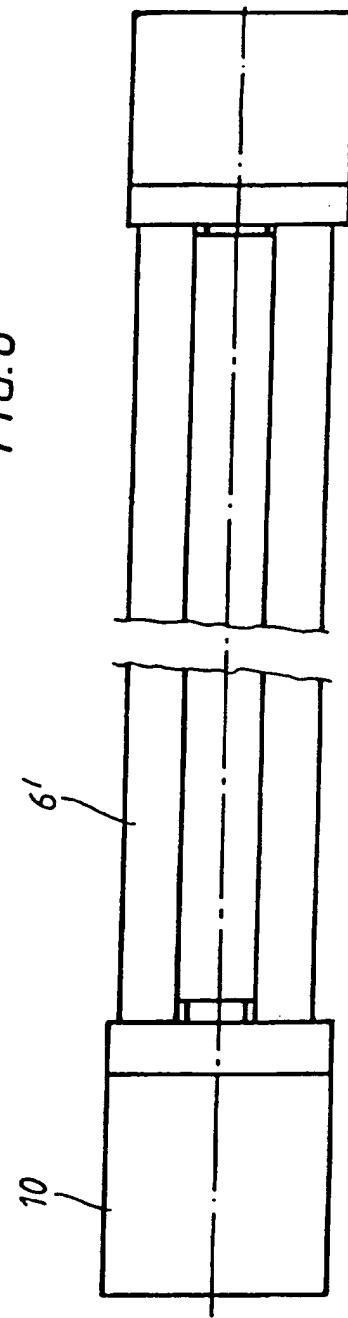


FIG. 6



Pleat-like protective cover

Protective covers for machine tools and other processing machines are known in the art in the most varied forms. Thus telescopic covers are frequently used which consist of a plurality of interengaging cover elements which can be pushed together telescopically and each have at least a top wall, two side walls and stops for the neighbouring cover element. However, if the depth chosen for a cover element is too large, tilting can occur during displacement. The consequence of this, however, is that the ratio of depth of the cover elements to the width of the cover is relatively unfavourable.

Another type of telescopic cover is the so-called bellows used in machine tools for the protection of moving parts. In this case the bellows body is generally formed from a multi-layer cover, and the outer layer of this cover must in particular be resistant to the coolants which are sometimes very corrosive. The bellows body also generally has on the inside a reinforcing layer which must be chosen to be sufficiently strong bearing in mind the attack by shavings to which the bellows are exposed. However, by comparison with telescopic covers the bellows is substantially less stable and limited in its pleat height to approximately 60 mm.

The object of the invention, therefore, is to improve the pleat-like protective cover in such a way that it is distinguished by a greater stability of shape.

This object is achieved according to the invention in that the protective cover is characterised by a plurality of segments which are connected to one another by hinge-like coupling elements.

Further embodiments of the invention are the subject matter of the subordinate claims.

The protective cover according to the invention is particularly suitable for machine tools and other processing machines in which within their processing range coolant and lubricant come out and shavings and/or dust are produced.

Further advantages and embodiments of the invention are explained in greater detail with the aid of the description of an embodiment and the drawings, in which:

Figure 1 shows a partially sectional side view of the protective cover according to the invention;

Figure 2 shows a sectional representation along the line II-II in Figure 1;

Figure 3 shows a sectional part-view of the connection of segment and coupling element;

Figure 4 shows a sectional, enlarged part-view of the segment;

Figure 5 shows a sectional representation along the line V-V in Figure 1 and

Figure 6 shows a sectional representation along the line VI-VI in Figure 1.

The pleat-like protective cover illustrated in the drawings consists essentially of a plurality of segments 1 which are connected to one another by hinge-like coupling elements 2. The rigidly constructed segments 2 can be produced for example from flat aluminium extrusions. Depending upon the place where they are to be used and the necessary stability, hollow sections can also be used.

The coupling elements 2 are advantageously made from an elastic material, for example from an elastic plastics material.

For connection of the segments 1 and the coupling elements 2 there are provided along the longitudinal end faces 1a of the segments 1 cut-outs 1d into which the coupling elements 2 can be introduced with a part 2a which is of corresponding complementary construction. The coupling elements 2 can be simply introduced transversely with respect to the direction of movement 3 (see Figure 1) of the protective cover, whilst when the protective cover is being extended or closed up unintentional release of the connection between segment and coupling element is prevented.

The segments 1 and coupling elements 2 co-operate in such a way that when the protective cover is pushed together successive segments fold in on alternate sides, as is shown in the left-hand part of Figure 2. In the fully extended state according to the right-hand part of Figure 2 the individual segments 1 form a substantially plane wall.

In order to prevent the individual segments from folding in to the wrong side, either the segments 1 or the coupling elements 2 can be appropriately constructed. In the embodiment shown in the drawings both the segment and the coupling element are constructed in such a way that folding in of the segments on alternate sides is favoured.

The part of the segment 1 which comes into connection with the coupling element 2 is illustrated in an enlarged sectional view in Figure 4. The cut-out 1b is formed by a narrow groove beginning on the longitudinal end face 1a and widening in a circular shape in cross-section in the interior of the segment 1. Therefore the part 2a of the coupling element 2 which is of correspondingly complementary construction (see Figure 3) can merely be introduced into the cut-out 1b at right angles to the drawing plane of Figure 4 and can be stressed in the direction of the arrow 4 without the connection between segment 1 and coupling element 2 being released. The groove

of the cut-out 1b is delimited on one side by a substantially plane surface 1c and on the other side by a strongly curved surface 1d. Following the principle of least resistance the coupling element 2 will lie on the curved surface 1d when the segments 1 are folded in.

In order further to intensify the direction of folding which is already favoured by the construction of the segment 1, the coupling element 2 likewise has a special construction. As can be seen in particular from the fully extended protective cover shown in Figure 2, the coupling element 2 has a greater amount of material 2b on one side of the protective cover and merely a lesser amount of material 2c on the other side. In this case the greater amount of material 2b strikes the longitudinal end faces 1a of the neighbouring segments, so that folding in of the segments on this side would only be possible by compression of this amount of material 2b. On the other side the amount of material 2c is merely constructed in the middle between the two segments and is, moreover, substantially smaller. As a result the segments can fold in on this side unhindered. Thus the smaller amount of material 2c is provided merely for reasons of stability. Moreover, it can serve as soundproofing since it prevents neighbouring segments from striking one another.

Naturally, within the scope of the invention other constructions are also conceivable for ensuring that the segments fold in on alternate sides. Thus the coupling elements 2 can in particular be prestressed in one direction to promote the folding in.

The segments 1 are each guided transversely with respect to the direction of movement 3 of the protective cover in a guide rail 5, 6. For this purpose the segments 1 are provided with centrally disposed guide bodies 7, 8 on the lateral end faces, i.e. the faces located transversely with respect to the

direction of movement 3. The guide bodies 7, 8 are formed for example by bolts by means of which the segments 1 are retained in the guide rails 5, 6 so as to be both slidably movable and pivotably movable.

The protective cover according to the invention can be disposed in any spatial position. Depending upon the alignment and application, however, suitable steps must be taken in order to ensure satisfactory operation. Thus in particular in the case of a vertical arrangement, i.e. in the case of a horizontal direction of movement of the protective cover for a machine tool which produces a large amount of shavings thought must be given to ensuring that blocking of the protective cover is not caused by accumulations of shavings.

Figures 5 and 6 show one embodiment of a vertically disposed protective cover in which the segments 1 are retained by guide bodies 7' in an upper guide rail 5' and by guide bodies 8' in a lower guide rail 6' so as to be slidably and pivotably movable. The upper guide rail 5' has a groove which is T-shaped in cross-section, in which is guided the guide body 7' which is likewise of T-shaped construction. The guide body 7' is connected to the segment 1 by a suitable fixing means 9, for example a screw.

The lower guide body 8' is for example of cylindrical construction and is guided in a recess of rectangular cross-section in the lower guide rail 6'.

The guide bodies 7', 8' facilitate on the one hand a sliding movement in the upper and lower guide rails 5', 6' and on the other hand a pivoting movement of the segment 1 about its longitudinal axis i.e during the folding operation.

In order to prevent accumulations of coolants and lubricants, shavings and/or dust in the region of the lower guide rail 6',

the upwardly directed end faces 6'a thereof are chamfered. Moreover, the guide groove is constructed so that it is open towards the bottom, so that any foreign bodies entering from above fall through downwards.

Naturally, within the scope of the invention other constructions of the guide rails are also conceivable which prevent the undesirable accumulations of shavings and other such materials.

Depending upon the local conditions and the field of application, the guide rails 5, 6 or 5', 6'; can be connected to one another to form a frame.

Furthermore, between two segments a fixing part can be disposed which co-operates with a movable part of a machine tool or other processing machine.

The protective cover which consists merely of the segments 1 and the coupling elements 2 can be adapted in a simple manner to the most varied applications, simply by appropriate construction of the width and length of the segments, whilst the coupling elements merely have to be adapted in length.

The coupling elements are advantageously produced from a plastics material, for example polyurethane, which is emulsion-resistant and heat-resistant and is designed for continuous bending stress.

The protective cover according to the invention is distinguished by a high stability whilst requiring comparatively little space.

Claims

1. Pleat-like protective covering, particularly for machine tools, characterised by a plurality of segments (1) which are connected to one another by hinge-like coupling elements (2).
2. Protective cover as claimed in Claim 1, characterised in that the segments (1) are rigidly constructed.
3. Protective cover as claimed in Claim 1, characterised in that at least individual segments (1) are retained in a guide rail (5, 6; 5', 6') so as to be slidably movable and pivotably movable.
4. Protective cover as claimed in Claim 1, characterised in that the segments (1) are constructed as flat longitudinal profiles.
5. Protective cover as claimed in Claim 1, characterised in that the segments (1) have cut-outs (1b) into which the coupling elements (2) can be introduced.
6. Protective cover as claimed in Claim 1, characterised in that the coupling elements (2) extend transversely with respect to the direction of movement (3) of the protective cover over the entire length of the segments (1).
7. Protective cover as claimed in Claim 1, characterised in that the coupling elements (2) are made from elastic material, preferably from elastic plastics material.
8. Protective cover as claimed in Claim 1, characterised in that the segments (1) and the coupling elements (2) co-operate in such a way that when the protective cover is pushed together successive segments (1) fold in on alternate sides.

9. Protective cover as claimed in Claim 8, characterised in that successive coupling elements (2) are prestressed in opposing directions in order to promote the folding in.

10. Protective cover as claimed in Claims 3 and 4, characterised in that the segments (1) each have a guide body (7, 8; 7', 8') on the end faces located transversely with respect to the direction of movement (3) of the protective cover.

**Patents Act 1977**

**Examiner's report to the Comptroller under Section 17  
(The Search report)**

*61*

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**Relevant Technical Fields**

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(ii) Int Cl (Ed.6) F16P 1/00, 1/02; B23Q 11/08

**Search Examiner**  
M MCKINNEY

**Date of completion of Search**  
26 JANUARY 1996

**Databases (see below)**

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE:WPI; EDOC

**Documents considered relevant following a search in respect of Claims :-**  
1-10

**Categories of documents**

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|----|---|----|---|
| X: | Document indicating lack of novelty or of inventive step.   | P: | Document published on or after the declared priority date but before the filing date of the present application.        |
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| A: | Document indicating technological background and/or state of the art.   | &: | Member of the same patent family; corresponding document.   |

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2077878 A	(SCHMIDBERGER) see Figures	1, 2 and 4-9
X	GB 1575338	(HENNIG) see Figures	1-4 and 6
X	EP 0415025 A2	(KABELSCHLEPP) see Figures	1-9
X	US 4784544	(MORITZ) see Figures	1, 2 and 4-9

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